

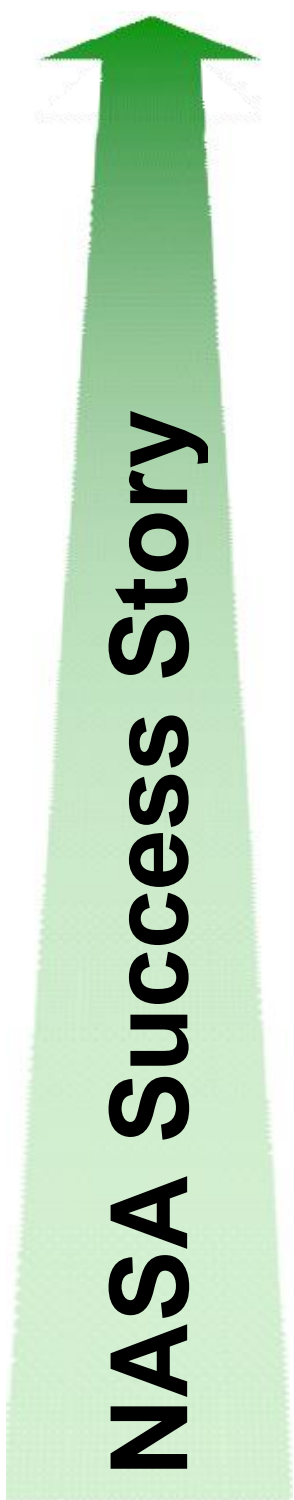
# Cryogenic Life Support Technology Development Project

## Description

KSC has used cryogenic life support (liquid air based) technology successfully for many years to support spaceflight operations. This technology has many benefits unique to cryogenics when compared to traditional compressed gas systems: passive cooling, lighter, longer duration, and lower operating pressure. However, there are also several limiting factors that have prevented the technology from being commercialized. The National Institute of Occupational Safety and Health, Office of Mine Safety and Health Research (NIOSH-OMSHR) has partnered with NASA to develop a complete liquid air based life support solution for emergency mine escape and rescue. The project will develop and demonstrate various prototype devices and incorporate new technological innovations that have to date prevented commercialization.

## Success Story

To date KSC has developed new technologies that have resolved many of the challenges preventing commercialization. Liquid air storage has been improved by the use of a "Zero Loss Storage System" that prevents loss of liquid air over time and also prevent enrichment (spoiling of the liquid air). We have developed liquid air Self Contained Breathing Apparatuses (SCBA) that can function in any orientation (attitude independency). These cryogenic SCBAs can also be filled quickly and easily by a simple quick disconnect. They can also be topped off while the user continues to breathe on them. We have also developed a system that passively maintains air quality in an emergency mine refuge chamber. This system provides fresh air, while circulating, cooling, and dehumidifying at the same time without the use of electricity.

A large green arrow pointing upwards, with the text "NASA Success Story" written vertically inside it.

**NASA Success Story**



Live Demonstration of the first prototype Cryogenic Breathing Apparatus at a mining technology conference.



Breathing on the Cryogenic Breathing Apparatus while simultaneously filling it from the Cryogenic Air Storage and Fill System.

## Benefit

All of these advances are moving the use of liquid air based life support closer and closer to the point where it can be successfully commercialized. A commercially available liquid air SCBA could allow fire fighters to work longer while reducing heat stress. Refuge chamber air systems could be used not only in mines, but perhaps in military vehicles to preserve a breathable atmosphere in a toxic environment. Medical workers could use liquid air based breathing systems to protect themselves from highly contagious and deadly diseases while working longer and preventing heat stress. The benefits of this technology are numerous and the potential applications are many for situations that use current compressed gas life support solutions.

For NASA, many of these technologies are currently being considered for incorporation into our existing cryogenic life support equipment. With these new innovations, we can reduce operational costs while at the same time improving safety and comfort for the users.

<b>Lead NASA Center:</b>	KSC
<b>Funding Organization:</b>	NIOSH-OMSHR
<b>Date of Success:</b>	August 2015